

APPENDIX J
INDICANT STEERING COLUMN DISPLACEMENT

APPENDIX K INDICANT STEERING COLUMN DISPLACEMENT

1. STEERING COLUMN DISPLACEMENT - PHOTOGRAPHIC ANALYSIS

The Federal Motor Vehicle Safety Standard (FMVSS) 204 requires that the steering control system not displace more than 5 inches horizontally rearward when a vehicle (unloaded vehicle weight) impacts a rigid barrier at a velocity of up to 30 mph. The FMVSS 204 indicant test can be used in conjunction with frontal barrier impact tests such as those conducted to determine compliance to FMVSS 208, Occupant Crash Protection. The results of the testing will be used to identify vehicles with failure potential.

The steering column movement is to be captured on film by two side view cameras (camera 5 and 6 in the FMVSS 208 test). The control points panel, Figure 1, is to be recorded on film prior to the barrier impact test. The film is analyzed using mathematical techniques based on projective geometry which resects the flat plane image to determine the horizontal and vertical displacement of the steering control system.

2. PHOTOGRAPHIC COVERAGE

The contractor shall report all camera locations along with camera speeds and lens focal lengths on the appropriate data sheets.

CAMERAS REQUIRED

Two side view cameras (Camera Nos. 5 and 6 from the FMVSS 208 test) are needed to record the steering column target in conjunction with the moving reference targets. Both cameras must have fields of view that are as narrow as practical while still having unobstructed views of both the time zero and the projected post impact locations of the steering column and moving reference targets. In any case, the fields of view may not exceed 9 feet in width. Filming of other targets is strictly optional. The cameras may be positioned with pitch and/or yaw angles of up to ± 40 degrees.

The cameras must be capable of a "pre-run" operation, i.e. they can be set for a slow frame rate for recording the position of the Resection Control Points Panel prior to the actual test run, and then stepped up to 1000 frames per second (fps) with wider apertures for recording the actual test. Pre-run frame rates of between 10 and 50 fps are acceptable. A minimum of 5 clearly exposed frames taken by each camera of the resection panel are required.

To maximize the steering column target's visibility, the driver's side outside rearview mirror must be removed, and efforts should be made to minimize reflections from the driver's side window which might obscure the target during the test. Devices such as baffles on the lighting, polarizing filters on the cameras, and anti-glare spray on the window glass should be used if reflections are observed during the test setup.

FILM EDITING

The film shall be edited to include each steering column camera's "pre-run" spliced together with that camera's footage from the actual test.

3. RESECTION CONTROL POINTS PANEL

A panel bearing eight resection control points must be fabricated for inclusion in pre-run filming using the left side view steering column cameras. The panel may deviate no more than 1/4 inch from perfect flatness, when suspended. The four outer targets must be placed within 1/32nd of an inch of the corners of a square measuring 36 inches on each side. Four inner targets must be placed at the midpoints of each 18 inch side of a square located 9 inches inside of the outer square. To double check, the diagonal measure between outer square targets should be 50.9 inches, and there should be 12.73 inches between adjacent inner square targets.

RESECTION CONTROL POINTS PANEL

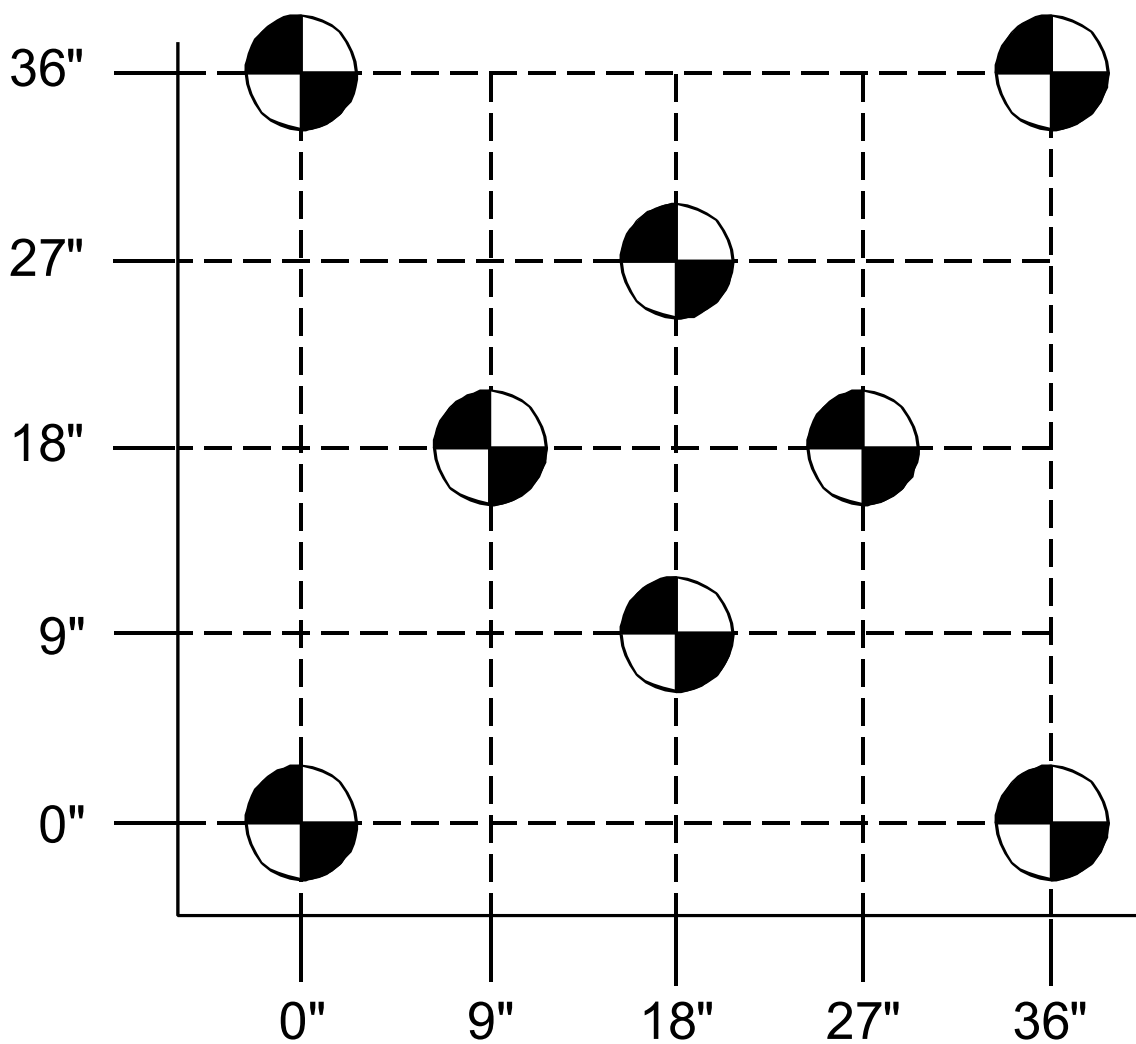
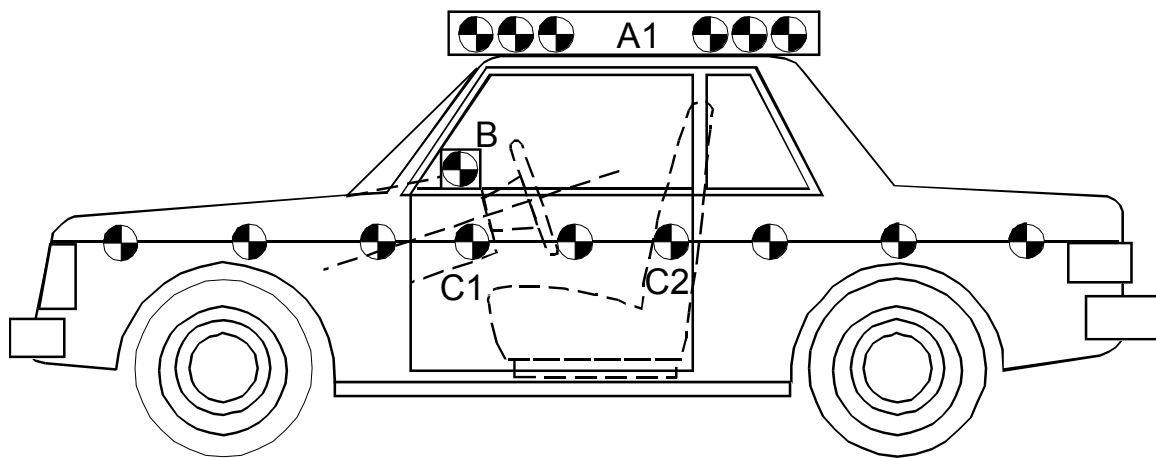


FIGURE 1

4. TARGETING

See Data Sheet 28 for initial vehicle targeting. The primary moving reference target A1 (Figures 2, 3, and 4) **MUST BE MOUNTED** on a flat rectangular panel, and be firmly fixed to a structure of the vehicle that remains undisturbed by the crash, such as the vehicle roof. The panel must be in the same plane as the plane of motion (Figure 3). The setup rotation of the panel within the motion plane is unimportant. To insure against unexpected displacements of the car top, the backup moving reference targets C1 and C2 should also be attached to undisturbed

TEST VEHICLE TARGETING



LEFT SIDE VIEW

FIGURE 2

portions of the vehicle, such as the vehicle door or body.

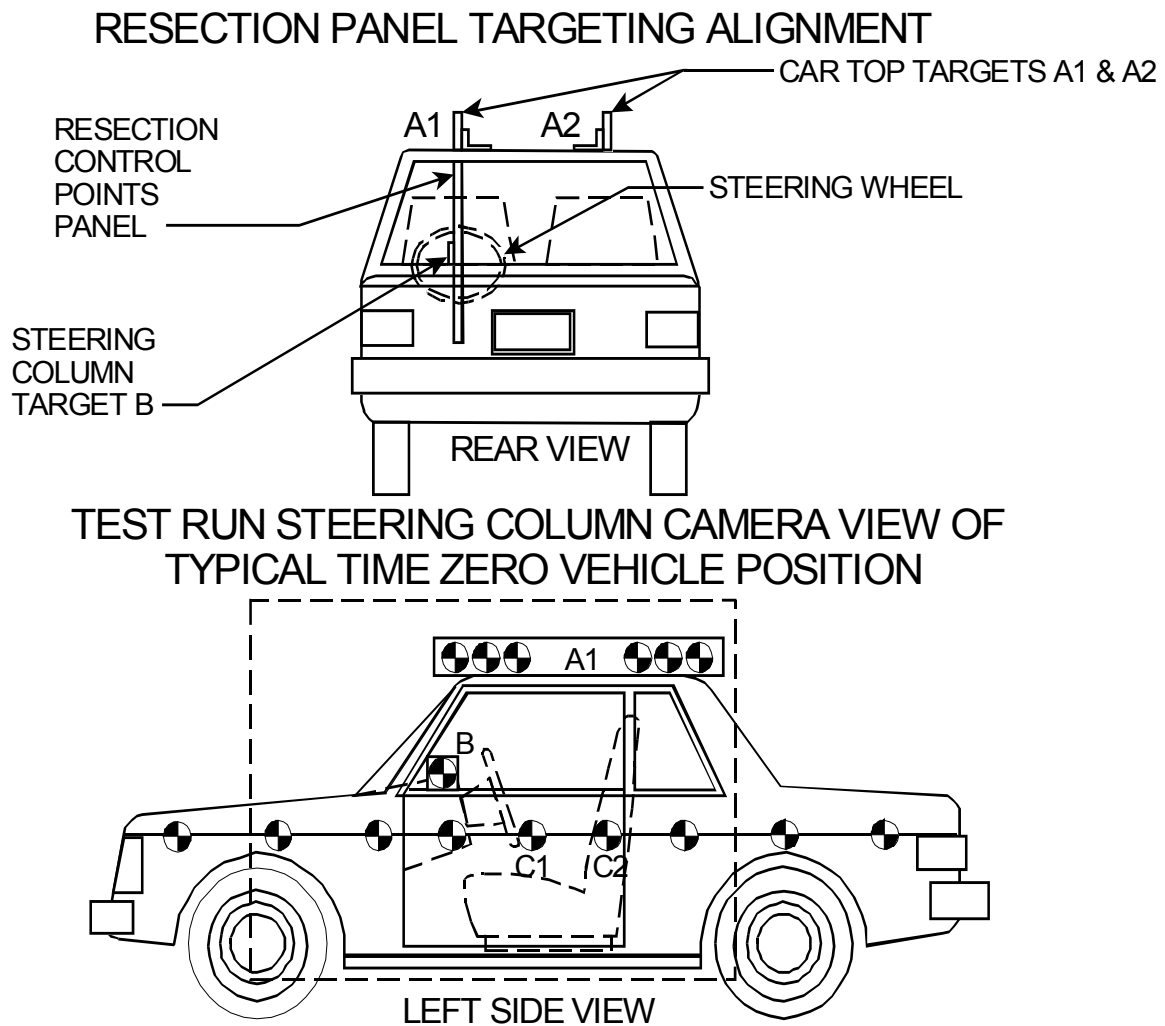
The moving reference targets (A1, C1/C2) must be in view of the two side view cameras from approximately $T = -20$ ms to the end of the event to accurately determine the rearward displacement of the steering control. Target and camera placement are very important and should be checked carefully.

The steering column target B must be firmly fixed to the column such that the target will not flex in and out of the plane of the column.

Photographic targets should be placed at one foot intervals along the side of the vehicle. Target placement should be documented. Record distance between the plane of steering column target B and the plane of backup moving reference targets C1/C2.

Circular targets with black and yellow quadrants and having AT LEAST 90 mm diameters should be used for targeting references A, B, and C, as well as the resection panel.

NOTE: ALL PROPOSED CHANGES MUST BE APPROVED BY THE COTR.

**FIGURE 3**

5. PRETEST REQUIREMENTS

To perform a planar resection of the steering column camera views, the Resection Control Points Panel described above must be firmly suspended or otherwise fixed in the field of view. The panel should be roughly centered over the steering column target's time zero position (Figure 3), and must be coplanar with both the steering column target B and the target group A, which are both parallel to the plane of motion. Alignment with the backup moving reference target group C is not critical.

PRE-RUN VIEW WITH CONTROL POINTS PANEL SUPERIMPOSED ON TYPICAL TIME ZERO VEHICLE POSITION

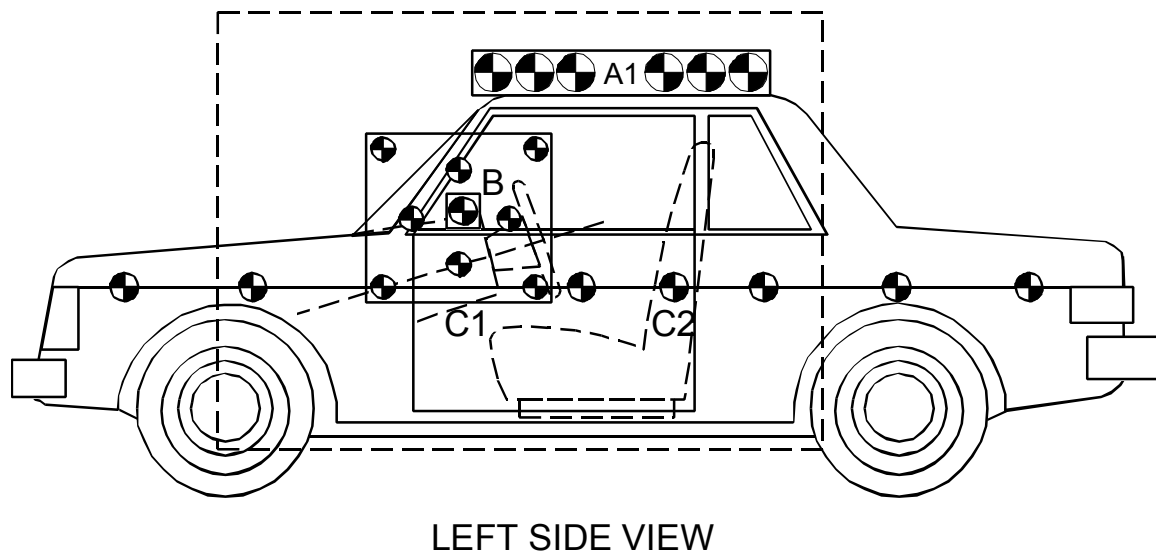
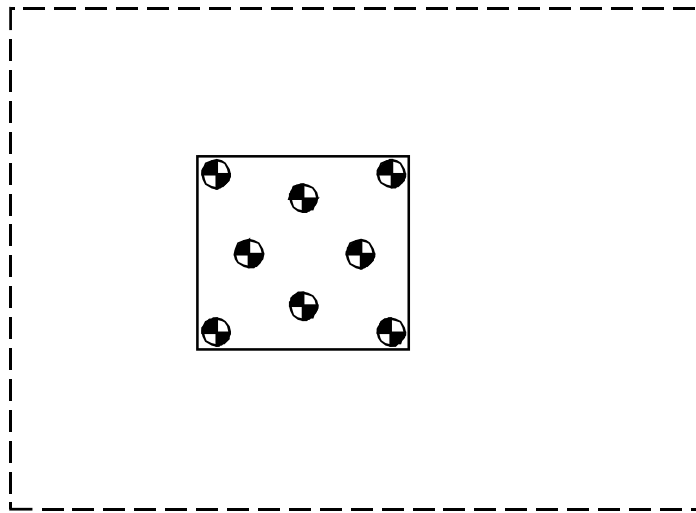


FIGURE 4

The control points panel's top and bottom edges should be within 2.5 cm of being parallel to the ground.

After the Resection Panel has been installed, the two cameras viewing the steering column should be "pre-run" to record the panel's position. The panel must then be removed, and the cameras' frame rates and apertures reset for the actual test run without disturbing their alignment or focal lengths.

PRE-RUN STEERING COLUMN HIGH SPEED CAMERA VIEW



LEFT SIDE VIEW

FIGURE 5

6. POST TEST REQUIREMENTS

The film footage from each steering column camera's "pre-run" must be spliced together with that camera's footage from the actual test. A position check must be performed to determine that the moving reference targets have not been displaced by the impact, relative to the undisturbed rear half of the vehicle, and that the steering column target is still firmly attached.

Collect data necessary to complete all information in data section; including any other information that is pertinent to the test and providing narrative details in all descriptions.

The film data will be analyzed to obtain the horizontal displacement versus time and vertical displacement versus time presented in both graphical and tabular formats.